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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/799,413	03/12/2004	Angela T. Hui	AF01158	7136
7590	05/18/2006		EXAMINER [REDACTED]	MAI, ANH D
Kelly K. Kordzik Winstead Sechrest & Minick P.C. P.O. Box 50784 Dallas, TX 75201			ART UNIT [REDACTED]	PAPER NUMBER 2814

DATE MAILED: 05/18/2006

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**BEFORE THE BOARD OF PATENT APPEALS  
AND INTERFERENCES**

Application Number: 10/799,413

Filing Date: March 12, 2004

Appellant(s): HUI ET AL.

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Robert A. Voigt, Jr  
Reg. No. 47,159  
For Appellant

**EXAMINER'S ANSWER**

This is in response to the appeal brief filed January 25, 2006 appealing from the Office action mailed October 18, 2005.

**(1) Real Party in Interest**

A statement identifying by name the real party in interest is contained in the brief.

**(2) Related Appeals and Interferences**

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

**(3) Status of Claims**

The statement of the status of claims contained in the brief is correct.

**(4) Status of Amendments After Final**

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

**(5) Summary of Claimed Subject Matter**

The summary of claimed subject matter contained in the brief is correct.

**(6) Grounds of Rejection to be Reviewed on Appeal**

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

**(7) Claims Appendix**

The copy of the appealed claims contained in the Appendix to the brief is correct.

**(8) Evidence Relied Upon**

6,110,779	Yang et al.	8-2000
6,197,637	Hsu et al.	3-2001
6,034,395	Tripsas et al.	3-2000

### **(9) Grounds of Rejection**

The following ground(s) of rejection are applicable to the appealed claims:

#### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

1. Claims 1-5 and 10-15 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 1, lines 9-11, recites: “etching a portion of said anti-reflective coating layer over said STI region leaving a remaining portion of said anti-reflective coating layer over said STI region and extending beyond the boundaries of said STI region”

How can etching a portion of ARC that lies over the STI region and still leaving the remaining portion of ARC over the STI ?

The claims must meet the threshold requirement of clarity and precision (MPEP 2173.02). Accordingly, as recited in claim 1, the anti-reflective coating layer are fully exposed therefore, “etching a portion of said anti-reflective coating layer” would remove the anti-reflective coating layer as a whole.

Once removed, the ARC is *no longer* situated over the STI, however, the limitation seems to indicate that nothing is removed or at most a top portion is removed.

Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Similarly, lines 12-14 recites: "etching an exposed portion of said polysilicon layer and said gate oxide layer over said STI region leaving a remaining portion of said polysilicon layer and said gate oxide layer over said STI region and extending beyond the boundaries of said STI region".

The similar also applies to claim 10, lines 7-9.

2. Claim 1 recites the limitation "etching an exposed portion of said polysilicon layer and said gate oxide layer over said STI region" in lines 12-13. There is insufficient antecedent basis for this limitation in the claim.

Neither the polysilicon nor the gate oxide **have been exposed**, because the anti-reflective coating layer is still remaining over the STI region and extending beyond the boundaries of the STI region (line 9, depositing an anti-reflective coating layer over said polysilicon layer). (See lines 10-12).

The following is suggested to clarify the claims and alleviate the indefiniteness:  
"selectively etching a portion of the anti-reflective coating layer over said STI region leaving a remaining portion of said anti-reflective coating layer over the edge of said STI region

and extending beyond the boundaries of said STI region, to expose a portion of said polysilicon layer”.

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 10, 11, 14 and 15 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsu et al. (U.S. Patent No. 6,197,637) in view of Yang et al. (U.S. Patent No. 6,110,779).

With respect to claim 10, as best understood by the examiner, Hsu teaches a method for avoiding oxide gouging in isolation regions of a semiconductor device substantially as claimed including:

forming an isolating region (230), the isolating region (230) being filled with insulating material;

depositing an anti-reflective coating, hereinafter ARC, layer (241a) over the isolation region (230) and extending beyond the boundaries of the isolation region (230);

etching a portion (242) of the ARC layer (241a) over the isolation region (230) leaving a remaining portion of the ARC layer (241a) over the isolation region (230) and extending beyond the boundaries of the isolation region (230); and

depositing a protective cap (246) covering the isolation region (230) and extending beyond the boundaries of the isolation region (230), wherein the protective cap (246) covers the

remaining portion of the ARC layer (241a) and the insulating material over the isolation region (230). (See Figs. 5B-C).

Thus, Hsu is shown to teach all the features of the claim with the exception of utilizing STI as isolation region.

However, Yang teaches that STI (76) can be alternatively used as isolation regions (see Fig. 4) and the process is well known to include: etching a trench in an STI region; and filling the trench with an insulating material (76). (See Fig. 4).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the isolation region of Hsu utilizing the STI as taught by Yang because STI can be formed with narrow profile and devoid of bird's beak, hence more active surface area, thus more devices can be formed on a given semiconductor surface (ULSI).

Regarding anti-reflective coating or ARC, many materials, such as oxide, nitride and oxynitride, can be used for, or function as, anti-reflective coating. The materials 241a of Hsu or 60 of Yang are one of them.

With respect to claim 11, the method of Hsu further comprises:  
etching a portion of the protective cap (246) to expose the remaining portion of the ARC layer (241a) while maintaining protection of the insulating material (230); and  
etching the remaining portion (241) of the ARC layer (241a);

wherein the insulating material (230) is protected during etching of the remaining portion (241) of the ARC layer (241a) by the protective cap (247). (See Figs. 5C-E).

With respect to claim 14, in view of Yang, the remaining portion of the ARC layer (60) can be etched using dry etch, hence plasma etch process.

With respect to claim 15, as best understood by the examiner, the insulating material (230) of Hsu comprises thermal oxide.

4. Claims 12 and 13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hsu '637 and Yang '779 as applied to claim 10 above, and further in view of Tripsas et al. (U.S. Patent No. 6,034,395).

With respect to claim 12, Hsu teaches depositing a protective cap (246) covering the isolation region (230) and extending beyond the boundaries of the isolation region.

Thus, Hsu is shown to teach all the features of the claim with the exception of depositing protective cap utilizing photoresist material.

However, Tripsas teaches: photoresist material are known to use as a protective cap (40). (See Fig. 3a).

Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to deposit the protective cap of Hsu utilizing photoresist material as taught by Tripsas because the photoresist is deposited by spin-on, thus simplifies the process, hence more throughput.

With respect to claim 13, the protective cap (40) of Tripsas is deposited to cover the polysilicon having a thickness of 600 Å to 1100 Å, thus, the protective cap (40) should have a thickness approximately the same. (See Fig. 3a-b, col. 6, lines 57-67).

Note that, the claimed thickness does not appear to be critical.

The specification contains no disclosure of either the *critical nature of the claimed thickness of the photoresist material* of any unexpected results arising therefrom. Where patentability is aid to based upon particular chosen dimension or upon another variable recited in a claim, the Applicant must show that the chosen dimension are critical. *In re Woodruff*, 919 F.2d 1575, 1578, 16 USPQ2d 1934, 1936 (Fed. Cir. 1990).

#### **(10) Response to Argument**

##### Rejection under 35 U.S.C. 112, second paragraph

Appellant contends that the scope of the claimed subject matter in claims 1-5 and 10-15 can be determined by one having ordinary skill in the art.

However, MPEP 2173.02 requires the claim must be clarity and precision. As recited, neither claims 1 nor 10 satisfy that requirement.

One having ordinary skill in the art can only determine the subject matters that are present in the claims rather than referring back to the specification for the subject matters that are not claimed.

Appellant states: respectfully direct the Board's attention to at least page 8, lines 1-3 of the specification and Figure 3B. (Page 15).

The statement in itself clearly require the one having ordinary skill in the art to find the unclaimed elements to understand the scope of the claim. Therefore, clarity and precision are clearly lacking.

As clearly indicated that although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). It is noted that the features upon which applicant relies (i.e., a portion of the anti-reflective coating layer 34 was etched over the STI region 14) are not recited in the rejected claim(s).

As discussed above, the terms “selectively etching” and “to expose a portion of said polysilicon layer” have been suggested to clarify the subject matter.

However, the Appellant rather referring one having ordinary skill in the art ordinary skill in the art to the specification to comprehend the scope of the claim.

Furthermore, Appellant appears to suggest that the scope of the claim should be narrowly read in light of the specification. While the Board always reminded the Office to give the claim its broadest interpretation not narrowly including the elements from the specification.

The Appellant further asserts: “M.P.E.P 2173.02 further states that the definiteness of claim language must be analyzed, not in a vacuum, but in light of: the content of particular application disclosure; the teaching of the prior art; and the claim interpretation that would be given by one possessing the ordinary level of skill in the pertinent art at the time the invention was made.”

Claims 1 and 10 recite: (a) etching a portion of said anti-reflective coating layer over said STI region leaving a remaining portion of said anti-reflective coating layer over said STI region

and extending beyond the boundaries of said STI region; (b) etching *an exposed portion of* said polysilicon layer *and said gate oxide layer* over said STI region leaving a remaining portion of said polysilicon layer and said gate oxide layer over said STI region and extending beyond the boundaries of said STI region. (emphasis added).

The above only indicated etching a portion of the anti-reflective coating over the STI region and leaving everything intact. May be a portion of the coating layer is exposed.

However, when the polysilicon is exposed, the gate oxide layer is yet to be exposed. The specification, Fig. 3B, does not show that the gate oxide is exposed when the second etching begins.

Clearly, the claims are lacking clarity and precision and the rejection should be maintained.

Rejection under 35 U.S.C. 103 (a)

With respect to claim 10, Appellant argues that Hsu and Yang taken singly or in combination, do not teach or suggest “etching a trench in an STI region; filling said trench with an insulating material”.

However, in view of Yang, col. 6, lines 24-26 teaches: Although Fig. 3C disclose the isolation region 14a and 14b as field oxidized regions, the structure may alternatively use trench isolation structures 76, as shown in Fig. 4.

Appellant further argues that: there is no language in Yang that teaches etching a trench in a shallow (sic) trench isolation region. Appellants have performed a search of the term “STI” and was unable to identify this term or any variation thereof.

Appellant appears to agree with this Office that Yang does teach that trench isolation structure, etched and filled, can be used instead of field oxidation structure or LOCOS.

Appellant seems only to contend that the trench isolation of Yang is not the “shallow” trench isolation. (emphasis added).

Firstly, the term “shallow” is a relative term and does not include or exclude any depth.

Secondly, the term “STI” is well known in the art to identify an isolation structure formed by trench instead of LOCOS.

One having ordinary skill in the art should have no difficulty to confirm the isolation structure 76 of Yang as an STI.

The Appellant further assert that Hsu and Yang, taken singly or in combination, do not teach or suggest (a) “depositing an anti-reflective coating layer over said STI region and extending beyond the boundaries of said STI region” and (b) “etching a portion of said anti-reflective coating layer over said STI region leaving a remaining portion of said anti-reflective coating layer over said STI region and extending beyond the boundaries of said STI region” as recited in claim 10.

However, Hsu, in view of Yang, clearly teaches:

(a) depositing an anti-reflective coating layer (241) over the isolation region (230) (replaced by STI region 76, Yang) and extending beyond the boundaries of the isolation region (230) (replaced by STI region 76, Yang); (Fig. 5B);

(b) etching a portion of the anti-reflective coating layer (241) over the isolation region 230 (replaced by STI region 76, Yang) leaving a remaining portion of the anti-reflective coating

layer (241) over the isolation region (230) (replaced by STI region 76, Yang) and extending beyond the boundaries of the isolation region (230) (replaced by STI region 76, Yang). (Fig. 5C).

As discussed in the rejection, “anti-reflecting coating” is a functional limitation, there is no limit to any particular materials. Particularly, the materials 241 of Hsu or 60 of Yang are well known in the art to be used as “anti-reflecting coating”.

By arguing “neither is there an language in Hsu that teaches etching a portion of an anti-reflecting coating layer over an STI region, (emphasis added), the Appellant is arguing against the reference individually.

In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

The Appellant argues: Appellant use both term “STI” region and the term “insulating material” and restricts this Office from citing the same element for the different elements.

However, the Applicant does not seem to understand the claimed terms. The term “STI region” means area or location of the STI, the “insulating material” means the material that fills in the STI. In view of Yang, the trench is formed at their location, and material 76 is filled within the trench. The subject matter of the STI is easily determined by the one having ordinary skill in the art, but the claim limitations have to meet clarity and precision requirement.

With respect to claim 11, the Appellant argues that Hsu and Yang taken singly or in combination, do not teach or suggest “etching a portion of said protective cap to expose said remaining portion of said anti-reflective coating layer while maintaining protection of said insulating material” as recited in claim 11.

However, Hsu, in view of Yang, teaches exactly that: etching a portion of the protective cap (246) to expose the remaining portion of the anti-reflective coating layer (241) while maintaining protection of the insulating material (230).

The Appellant seems to argue that the reference must use the exact same terms as recited by the claim.

The Appellant should have known that the terms “protective cap” and “anti-reflective coating” are just functional limitation, while planarize is an etch to make planar. “Etching” does not reserve for any particular removal method. One having ordinary skill in the art should have no problem understanding this simple subject matter.

The Appellant further adds: Hsu and Yang, taken singly or in combination, do not teach or suggest “etching said remaining portion of said anti-reflective coating layer” as recited in claim 11.

However, from Fig. 5E, Hsu clearly teaches: etching the remaining portion of the anti-reflective coating (241).

In the remaining of the argument, the Appellant just repeats the same arguments as that of claim 10. Therefore, the same reason as above is repeated.

With respect to claims 14 and 15, Appellant appears to content that the limitations of claims 14 and 15 have not been taught by either references.

However, as clearly discussed in the rejection, claim 14, in view of Yang, the remaining portion of the ARC layer (60) can be removed using dry etch process. Dry etch is known in that art for plasma etch as oppose to wet etch for etching in a chemical bath.

In claim 15, as discussed in the rejection, the insulating material that fill the isolation structure 230 of Hsu comprises thermal oxide.

Thus, the *prima facie* case of obviousness have been established.

#### Motivation to Combine

The Appellant appears to admitted that Yang has provided the missing element of Hsu, replacing STI for field isolation. The Appellant further adds: “Appellant are confused as to why the Examiner is citing to Wolf when the Examiner is relying upon Yang to modified Hsu.”.

However, as discussed in the rejection of claim 10, the Appellant’s confusion is unfounded. The rejection clearly states: “Therefore, it would have been obvious to one having ordinary skill in the art at the time of invention to form the isolation region of Hsu utilizing the STI as taught by Yang because STI can be formed with narrow profile and devoid of bird’s beak, hence more active surface area, thus more devices can be formed on a given semiconductor surface (ULSI).”.

Since the teaching of the missing elements are provided by the reference is adequate to support for the motivation to combine. In the Remark filed August 5, 2005, attacking the

motivation to combine, the Appellant accused that, the motivation is that of Examiner's own subjective opinion.

The Appellant' statement appears to show the lacking of the fundament knowledge of the semiconductor art. Therefore, in the response, this Office further directed the Appellant to S. Wolf, Silicon Processing for the VLSI, Process Integration. Vol. 2, Lattice Press, page 45, to show that the drawn motivation are well known and not that of examiner's own.

The Appellant seems to disregard the fact that, according to Yang, STI and the field isolation LOCOS are interchangeable because they can be used to solve a same problem which is to provide isolation between the devices.

The Appellant' arguments in pages 19 to 21, appears to attack both Hsu and Yang for not teaching the claimed invention or addressing each other difficulties.

However, this line of argument does not seem logical because the matter at hand is for the patentability of the instant invention, not that of Hsu or Yang or Wolf.

With respect to claim 13, the Appellant argue that: "the Appellant could not locate any passage that includes the thickness of element.".

However, in the rejection, this Office clearly states: the protective cap (40) of Tripsas is deposited to cover the polysilicon, which having a thickness of 600 Å to 1100 Å, thus, the protective cap (40) should have a thickness approximately the same.

Tripsas, Fig. 3a, col. 6, lines 57-67, shows layer 40, which covers the highest point of the polysilicon layer 16a-c, which has a thickness of 600 Å to 1100 Å. One having ordinary skill in the art should easily concludes that the thickness of the protective cap layer 40, should be at least

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equal to that of the polysilicon layer 16a-c, because the photoresist layer 40 has cover the height of 600 Å to 1100 Å. Some how this elementary eluded the Appellant.

With respect to claim 12, Appellant appears to contend that the photoresist material, which can be deposited by spin-on is that the Examiner's own subjective opinion.

However, one having ordinary skill in the art should have no problem at this aspect of the technology. Appellant appears to have never been in a laboratory or a production line, because the deposition of the photoresist material is probably a simplest process, and the capital investment in the delivery of the photoresist onto a wafer is the least expensive of them all. It is so simple and least expensive such that an eye dropper can be used to deposit photoresist material onto a wafer. To the Appellant, it appears that simplicity and economy are not a good motivation, but to the one having ordinary skill in the art they are.

#### **(11) Related Proceeding(s) Appendix**

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Anh D. Mai

Conferees:

Mr. Ricky L. Mack, SPE.

Mr. Wael M. Fahmy, SPE.

The image shows two handwritten signatures. The top signature is for "Ricky L. Mack, SPE." and the bottom signature is for "Wael M. Fahmy, SPE." Both signatures are in cursive ink.